REMARKS

This paper is responsive to the Office Action dated January 22, 2007. In the amendments above, Claims 1 to 9 have been cancelled without prejudice in favor of newly added Claims 10 to 22 to more particularly point out and distinctly claim Applicants' invention. Support for newly added Claims 10 to 22 can be found, for example, at Claims 1 to 9; page 4, lines 1 to 25; page 7, lines 1 to 20; and page 8, lines 1 to 17. No new matter was added.

Examiner Interview

Applicants thank Examiner Sievers and Examiner West for the courtesy of a personal interview with Applicants' undersigned representative to discuss the outstanding Office Action and the Rose-Pehrrson, Zuckerman, and Visser references. The perceived deficiencies of the cited references were discussed, especially the fact that the invention herein is directed to a substantially oxygen free environment whereas the references are not. However, Examiner Sievers felt that the present claims as well as some proposed amendments to the claims that were discussed were not sufficient to distinguish over the cited references. Also, Examiner Sievers and Examiner West felt that the claims could benefit from possible meaningful structural distinctions.

Priority

In the Office Action the Examiner has indicated that the application should be amended to specifically reference PCT application No. PCT/IB2003/006442, filed December 23, 2003, of which the present application is a National Stage filing, as well as Spanish patent Application No. P-200300003, filed January 2, 2003. Examiner Sievers indicated at the interview that she no longer believes that this reference is necessary. Applicants believe that the relationship between the underlying PCT patent application and the present application is abundantly clear from the record.

Rejections under 35 U.S.C. § 103(a)

Claims 1, 6, and 7 have been rejected as being unpatentable over Rose-Pehrsson et al., U.S. Patent No. 5,469,369 ("Rose-Pehrsson") in view Zuckerman, U.S. Patent No. 4,423,407 ("Zuckerman"). Claims 2 and 3 have been rejected as being unpatentable over Rose-Pehrsson in view of Zuckerman, and further in view of the Llobet et al. publication ("Llobet"). Claims 4 and 5 have been rejected as being unpatentable over Rose-Pehrsson in view of Zuckerman and Llobet, and further in view of Lewis et al., U.S. Patent No. 5,959,191 ("Lewis"). Claim 8 has been rejected as being unpatentable over Rose-Pehrsson in view of Zuckerman, and further in view of Kurokawa et al., U.S. Patent No. 6,679,097 ("Kurokawa"). Claim 9 has been rejected as being unpatentable over Rose-Pehrsson in view of Zuckerman, and further in view of the Visser et al. publication ("Visser").

The above rejections are respectfully traversed.

Rose-Pehrsson has been cited as the primary reference in the above rejections. With regard to independent Claim 1, the Examiner essentially maintains that this reference teaches all the limitations of the claimed invention except for sensors based on semi-conductor-type metal oxides that work in the absence of oxygen, relying upon Zuckerman to teach the missing limitation. As discussed at the personal interview, and as set forth earlier and below, Applicants maintain (1) that other limitations in the claim are not taught by Rose-Pehrsson, nor by any of the secondary references cited by the Examiner, and (2) that Zuckerman does not disclose the limitation attributed to it by the Examiner. Finally, assuming *arguendo* that Zuckerman does teach the missing limitation, it is Applicants' position that it is improper to combine the teachings of Rose-Pehrsson and Zuckerman due to the incompatibility of their teachings.

Briefly, as set forth in the claims above, the invention herein is directed to a system for the detection of reducing and oxidizing gases in a carrier gas having an

oxygen content not exceeding 30 ppm of oxygen, which system comprises a plurality of detecting means, calibrating means, a sealed measuring chamber, means for connecting the carrier gas to the measuring chamber and means for processing and control of acquisition and data recognition. The gas-detection means are sensors based on semiconductor-type metal oxides, which are located into the measuring chamber. The measurements on the carrier gas are taken inside the chamber without the need to introduce additional oxygen into the sensors' structures, when the sensors are exposed to a carrier gas flow of constant value. The means of processing and control include a system of real-time recognition of the gases, which provides a diagram with delimited decision zones, in which the measurements taken on the carrier gas are situated and identified.

With regard to distinctions between the claimed invention and Rose-Pehrsson, the claimed invention requires that the measurements should be taken inside the chamber, when the sensors are exposed to a gas flow of constant value (see, new Claim 10). The cited limitation allows for an extremely fast calculation (order of ms) because a sampling system is not required but just means for connecting the carrier gas to the measuring chamber are required to permit the gas whose quality is to be evaluated to flow through the chamber in which the sensors are located. In contrast, Rose-Pehrsson takes measurements on samples (a sampling system is required, see, Column 4, lines 35 to 65), leading to a processing time which is not in the scale of milliseconds.

It should also be noted that, Rose-Pehrsson mentions the possibility of exposing the sensors in the array directly to sample air. Therefore, Rose-Pehrsson is teaching sensors which would operate exposed directly to air (air is a carrier gas with an oxygen content higher than 30 ppm of oxygen; see, in contrast, new Claim 10, directed to a carrier gas with an oxygen content not exceeding 30 ppm of oxygen).

Moreover, in Rose-Pehrsson it is clearly stated that the invention is an improved system and method to detect chemical warfare agents and other toxic vapors in varying

relative humidity (see, Column 2, lines 46 to 50). The meaningful scenario where these species have to be detected is in air (warfare gases and other toxics are aimed at producing human casualties), so the system is designed to work in the presence of oxygen. On the other hand, as recognized by the Examiner, it must be taken into account that the system of Rose-Pehrsson does not utilize metal oxide gas sensors but surface acoustic wave transducers.

The Examiner states in the Office Action that Zuckerman does not recite that oxygen is required for the sensor to detect an object gas. However, the Examiner does not take into account that the invention of Zuckerman is directed to an apparatus for monitoring the concentration of gases in air employing gas sensitive materials which change electrical characteristics in response to the presence of a gas of interest. See, Column 1, lines 5 to 9, of Zuckerman, where it is stated that Zuckerman's invention relates to apparatus and methods for monitoring the concentrations of gases in air (air is carrier gas with an oxygen content higher than 30 ppm of oxygen) employing gas sensitive materials which change electrical characters in response to the presence of a gas of interest in air.

Likewise in Column 2, lines 34 to 46, of Zuckerman, it is stated that the object of the Zuckerman's invention is to create a gas-sensing system which indicates the presence of even low levels of a subject gas in the environment, and that a further object is to develop a sensing system which quickly returns to nominal values when the sensor returns to an air environment.

In fact, the system of Zuckerman claims a gas sensor which is adapted to change electrical resistance in response to the presence of a determined concentration (ppm in air) of subject gas (see, Figures 6 and 7).

As can be seen, Figure 7 is a graphical representation of the response of Zuckerman's sensor in relative resistance versus time to the application of gas in a concentration of "10 ppm" for five minutes, removed for five minutes, etc. In said Figure

7, "0 ppm" means the removal of the subject gas and the exposition of the sensor to a plain air environment and, therefore, the sensor resistance returns rapidly to near its initial value (see, Column 9, lines 35-40, and Column 2, lines 11 to 14).

In this respect, it should be pointed out that when Zuckerman discloses that the "chlorine sensor does not respond adversely to ... oxygen ...," it does not suggest that his sensor will function in approximately the same fashion in an environment with or without oxygen, but it means that such a sensor does not partially respond to oxygen during detection of ppm of chlorine gas in the environment, that is, that oxygen does not work as an interfering gas in the sensor (see, Column 12, lines 17 to 28). It should be pointed out that concentration of ppm of chlorine in the environment means presence of oxygen while measuring the cited chlorine gas and, thus, possible interference of oxygen while measuring (see, Figure 7 and Column 12, lines 17 to 28, of Zuckerman).

On the other hand, the sensor of Zuckerman is not a typical metal oxide gas sensor. Instead, it is a complex structure of a metal (dominant) and a metal oxide. As a result, its working mechanism is based on sorption but not on chemical reaction. The latter is the well-known detection mechanism in metal oxide gas sensors (see, Column 8, lines 41-60, of Zuckerman).

With regard to distinctions between the claimed invention and Visser, the claimed invention requires that the sensors be located in a sealed measuring chamber and that the measurements be taken inside said chamber without the need to introduce additional oxygen into the sensor structures (see, new Claim 10). In contrast, Visser discloses a chamber with an aperture "a" and with an oxygen pump to transfer oxygen from the ambient air (see, page 1 and Figures 1 and 5 of Visser).

As can be read in the introduction of his paper, Visser explains that semiconductor-type sensors require the presence of oxygen in the measurement gas for proper operation and that in many applications where the aim is to detect combustibles in air, this

requirement is not a problem. However, a problem arises when the measurement gas contains only very small amounts of oxygen (for example, automotive engine exhaust gas).

Visser's document discloses a sensor device capable of measuring combustibles in a measurement gas that has a very small content of oxygen (for example, automotive engine exhaust gas where the concentration of oxygen is very small and variable). However, that measurement is possible thanks to the presence of an oxygen pump that introduces the amount of oxygen needed.

As a matter of fact, Visser discloses that the sensor operates with oxygen because the paper describes a sensor device incorporating at least one ZrO2 electrochemical cell which is used as an oxygen pump to introduce into the sensor structure the amount of oxygen necessary for the proper operation of the sensor. (See, abstract and whole document including drawings).

As explained, the semiconductor-type sensors of Zuckerman and Visser operate, as expected by the generally accepted working mechanism.

The general knowledge states that such sensors need air oxygen to detect traces of pollutants (either reducing or oxidizing species). The working mechanism is as follows: Gas-sensitive metal oxides are non-stoichiometric semiconductor materials because some oxygen atoms are missing (i.e., there are oxygen vacancies) in the lattice of the metal oxide. In the presence of air oxygen, oxygen atoms from the ambient are adsorbed on the surface of the metal oxide. Oxygen atoms are in fact ionosorbed, i.e., they abstract electrons from the conduction band of the metal oxide. In pure air, an equilibrium concentration of adsorbed oxygen is reached at the surface of the metal oxide, thus determining a baseline conductivity. In the presence of traces of reducing or oxidizing gases in air, a different equilibrium concentration of oxygen adsorbed at the surface is reached, which results in a conductivity change. If the pollutants are removed from the ambient (i.e., the material is again in pure air), the equilibrium concentration of oxygen adsorbed is again altered and the

material regains its baseline conductivity (i.e. the sensing mechanism is reversible). [See, PT Mosely, J. Norris and DE Williams, Edts, *Techniques and mechanisms in gas sensing*, The Adam Hilger Series on Sensors, IOP Publishing Ltd, Bristol, UK, 1991, pp. 119-125.]

In Rose-Pehrsson it is clearly stated that the invention is an improved system and method to detect chemical warfare agents and other toxic vapors in varying relative humidity (see, Column 2, lines 46 to 50). The meaningful scenario where these species have to be detected is in air (warfare gases and other toxics are aimed at producing human casualties), so the system is designed to work in the presence of oxygen. On the other hand, as recognized by the examiner, it must be taken into account that the system of Rose-Pehrsson does not utilize metal oxide gas sensors but surface acoustic wave transducers.

Assuming, *arguendo,* that Rose-Pehrsson and Zuckerman in combination do teach all the elements of the claimed invention, Applicant believes that the combination of these references is improper. There is no apparent purpose to combine the two, nor has the Examiner supplied one. In fact, the teachings of the two references are incompatible. The Rose-Pehrsson system is dependent upon the use of SAW sensors. The system would not be viable if the surface acoustic wave vapor sensors were replaced with semiconductor sensors that rely on electrical conductivity of the sensors. Furthermore, the system of Rose-Pehrsson uses direct sampling to the sensors using an air sample. Consequently, it would be impossible to adapt the Zuckerman sensor to the system of Rose-Pehrsson.

Accordingly, none of the references cited by the Examiner teach or suggest, either alone or in combination, the claimed invention as recited in independent Claims 10 and 19. In view of the remarks presented above, it is respectfully submitted that independent Claims 10 and 19 are patentable over the cited references. Furthermore, for at least the reason of their dependence, either directly or indirectly, from Claim 10 or 19, Claims 11

to 18 and 20 to 22 are also patentable. The Examiner is respectfully requested to withdraw the rejections and allow the application.

CONCLUSION

In view of the amendments to the claims above and the arguments presented herein, it is submitted that the Examiner's rejections have been overcome and should be withdrawn. The application should now be in condition for allowance.

Should any changes to the claims and/or specification be deemed necessary to place the application in condition for allowance, the Examiner is respectfully requested to contact the undersigned to discuss the same.

Reconsideration and allowance of the claims herein are respectfully requested.

Respectfully submitted,
WOLF, BLOCK, SCHORR & SOLIS-COHEN LLP.

May 29, 2007

By: William H. Dippert
William H. Dippert
Reg. No. 26,723

Wolf, Block, Schorr & Solis-Cohen LLP
250 Park Avenue, 10th Floor
New York, New York 10177
(212) 986-1116